

PERFORATION OF THE BOWEL IN TYPHOID FEVER.¹

By G. E. ARMSTRONG, M.D.,
OF MONTREAL, CANADA.

DURING the eighteen years that have elapsed since Leyden suggested the possibility of surgical relief in typhoid perforations, the feasibility of his suggestion has received most thoughtful consideration by clinicians throughout most of the countries in the old world and in the new. Thanks to the painstaking labors of Fitz, Liebermeister, Keen, Mason, Westcott, and many others, we have had put before us and now have access to a mass of information, statistical and other, showing with almost mathematical accuracy many of the chief points in the natural history of this most fatal lesion. It may be said to occur in from 2 to 5 per cent. of all cases of enteric fever; more frequently in adults than in children; more frequently in males than in females. It occurs generally, but by no means always, during the second or third week of the fever; in the great majority of cases at some point in the distal eighteen inches of the ileum; and when the intestinal contents escape freely into the great peritoneal sac the result is probably always fatal.

The results of surgical interference, although sometimes most disheartening, have in the aggregate saved many lives. The success so far is sufficient to stimulate us all to try and do better, and my great object this evening is to receive, or perchance give, some hint that applied at the bedside or operating table may enable us to do even better in the future than we have done in the past.

¹ Read before the Chicago Surgical Society, May 5, 1902.

During the past six years 932 cases of typhoid fever have been treated in the Montreal General Hospital. Perforation of the ileum occurred in thirty-four cases, or $3\frac{2}{3}$ per cent. In one case, of a most malignant type, with tympanites, dulled sensorium, and profound toxæmia, the perforation was first recognized at the autopsy. In thirty-three cases, the accident, if we may so call it, was recognized during life and the opening closed. Five of these recovered. In one other case the patient died five days after operation, and the pathologist reported that death was due to the typhoid toxæmia and not to the perforation. If that case be included, we had six recoveries in thirty-three cases, or 18.18 per cent. As to sex, there were twenty-one males and nine females. In three cases the sex is not stated. Of those that recovered, three were males and three females. The number of females in the recovery list is striking. There were twenty-one males operated upon, and three, or $14\frac{1}{4}$ per cent., recovered, and of nine females, three, or $33\frac{1}{3}$ per cent., recovered. In the list published by Keen in his "Surgical Complications and Sequels of Typhoid Fever," the sex is recorded in sixty-nine. Of these fifty-nine were males, and eleven, or 18.6 per cent., recovered, and ten were females, with five, or 50 per cent., recoveries. The percentage of recoveries among the females being in each list more than double that among the males. Does the thoracic type of respiration in woman result in a more limited diffusion of the escaped intestinal matters?

As to the pathogenesis of perforation little seems to be known. In reading over the case reports, I have been struck by the frequency in which many of the patients persisted in going about, perhaps doing their accustomed round of daily duties for days, and in some instances for a week or more after the onset of languor, headache, backache, and anorexia, and I have wondered if the men had, perhaps, been the greater sinners in this direction. In one of my own cases I extracted an ascaris lumbricoides through the perforation, and in another, several yards of *tænia saginata*. In several cases the initial pain was complained of during or shortly after a bath. Our

Montreal records, however, do not show any increase in the percentage of perforations since the adoption of tubbing as a therapeutic measure, nor do Osler's nor Hare's Brisbane statistics.

It must be admitted that we know but little of the etiology of perforation in enteric fever. Early to bed and late to rise embodies a good working rule.

Let us now consider one of the most important and, indeed, only too often, one of the most difficult questions connected with this subject, namely, that of diagnosis.

It is easy to name the symptoms of perforative peritonitis. They are familiar to you all. And yet how obscure the onset may be. It cannot be too strongly urged that with the onset of ominous symptoms the physician should associate with himself a surgeon of experience in abdominal work.

In very few of our cases has the occurrence of perforation been immediately followed by a characteristic and definite group of symptoms. The note of alarm is pain,—abdominal pain referred to the umbilical or hypogastric regions. A very common bedside note is to the effect that "at midnight on a certain date the patient complained of the sudden onset of abdominal pain; an enema was given and followed by a stool, semi-solid or watery, which gave great or complete relief. About four hours later the pain recurred, and the abdomen was then found to be tender on pressure at some point,—more frequently in the right hypochondrium,—and more or less rigidity with rounding up." This occurs so frequently in perforative cases that one is led to exclaim, here is the first error. Instead of an enema, propose an exploratory incision. On discussing this question with the physicians, their reply is that this complaint of suddenly occurring abdominal pain is not at all uncommon in typhoid, and that nine times out of ten it is permanently relieved by an enema. The first difficulty then resolves itself into the question of differentiating between colic and abdominal pain secondary to organic lesion. It can only be done by carefully studying its associated symptoms. They

say a man is known by the company he keeps, and the same may be said of abdominal pain in enteric fever.

The first associate symptom is tenderness; the second, rigidity, and the third, fixity in one spot. If this trio—pain, localized tenderness in a fixed spot, and rigidity—are found associated, one's worst suspicions should be thoroughly aroused. There is another symptom not generally emphasized that I have come to look upon as possessing considerable significance, and that is the change in type of respiration from abdominal to thoracic. This is most readily seen by freely exposing the chest and abdomen, and is sometimes made more evident by asking the patient to take a long breath. The temperature frequently rises or falls notably, but not invariably by any means. The same may be said of the pulse. Vomiting or nausea frequently occurs.

In a patient in fair condition the above symptoms will be sufficiently developed to give the carefully trained observer a fair idea of what has happened. But there are two conditions which may mislead even the most alert. The first is the occurrence of a very small pin-point perforation, particularly if near the cæcum, where a state of rest is more possible, and especially if sealed and temporarily closed by adherent omentum or adjacent coil of intestine. The great diagnostic feature here I have found to be *persistence* of a little pain and a little tenderness and a little rigidity with fluctuation in temperature and pulse. The *persistence* of these symptoms even in a mild degree should suggest the discussion of the propriety of exploratory incision. The symptoms, if due to colic, should disappear in a few hours, or change their location. Secondly, the occurrence of perforation in a patient with a tympanitic abdomen and profoundly toxic, almost comatose, may be absolutely unrecognizable by the most astute clinician, and only be found in the autopsy room. In a sense, these are of the least importance to recognize, because these patients are probably already beyond even the tender aid of modern surgery.

I have not found the presence or absence of leucocytosis a guide to be depended on. In one case it increased 50 per

cent. in the first two hours after perforation. In another case it was only 4600 eight hours after the occurrence of symptoms of perforation. In one instance it increased from 4000 to 10,000 in six hours. I then made an exploratory incision, and found no perforation, but an apparently acute infection of the mesenteric glands. The patient made a good recovery. In another case it was only 4000 eleven hours after perforation; two hours later the perforation was closed by operation and the patient recovered. It is a symptom to be carefully observed and considered in association with the presence or absence of other symptoms, but upon which alone no great reliance can be placed. Obliteration of liver dulness is insignificant, as the free border is so often tilted up by the distended intestines, particularly the transverse colon.

We have, then, in some cases great difficulty in making a diagnosis. It is sometimes impossible to be sure that a perforation has occurred, and we are face to face with a most hazardous condition; and I think that one great step forward will be taken when we admit to ourselves this limitation of our powers of diagnosis and, after a careful study and weighing of all the indications pro and con, assume the responsibility of advising an exploratory incision in selected cases. I think there is a greater degree of true conservative surgery in such a course than in standing by with our hands in our pockets taking chances. On two occasions I have opened the abdomen without finding any perforation. In one case no cause was found for the pain, and in the other swollen mesenteric glands. They both made a perfect recovery. I need hardly say here that, failing to find a perforation, a careful search should be made for the cause of the pain in the mesenteric glands, appendix vermiciformis, and sigmoid flexure.

When once the diagnosis of perforation is made, every means possible should be adopted to keep the infection localized. This can best be accomplished by arresting peristalsis so far as possible by prescribing absolute rest in bed, the withholding of all food by the mouth, avoidance of laxatives and enemata, and the application of ice to the abdomen. The wisdom of

administering morphia at this stage is questionable. It may, by relieving pain, tend to favor a longer excursion of the diaphragm and the greater effusion of the septic material from the lesion of the bowel.

The time to operate is a most important point to decide. Only second in importance to the arrival at a correct diagnosis is the question, when to operate.

There are a few ultra-conservatives who would not advise operation until there is evidence of localization, and then only an evacuation of pus. The ground for this attitude is that only then is there any chance of benefit from the operative procedure. Others would seem to show from statistics that operation should not be undertaken until after the shock has passed away, say in the second twelve hours' interval; while, again, others would operate as soon as the diagnosis is assured.

In our Montreal cases the operation was performed during the first twelve hours in ten cases, with four recoveries, or 40 per cent.; the second twelve hours in ten cases, with one recovery, or 10 per cent.

Of the twenty cases operated upon during the first twenty-four hours, five recovered, or 25 per cent.

During the third twelve hours in three cases, and they all died. In one case, forty-eight hours after perforation, died; in one case, sixty-eight hours after perforation, died; in one case, seven days after perforation, recovered, or 100 per cent.; in seven cases, time after perforation uncertain.

Of the six recoveries, one was operated on two hours after the perforation, one thirteen hours after, one eight hours, one ten hours, one five hours, and one seven days after.

The operation in the last case was really nothing more than the opening of an intra-abdominal abscess. Four of the five acute cases were operated on during the first twelve hours.

So far, then, as our experience goes, it indicates early interference. Forty per cent. of the cases operated on during the first twelve hours recovered, and only 10 per cent. of those operated on during the second twelve hours, while none recovered after the second twelve hours' interval save the one

operated on on the seventh day, and this man, as one of my friends pertinently remarked, owed his life more to the mercy of God than to good surgery.

These figures are obviously too small to form the basis of general theories or deductions, but nevertheless they are significant.

I feel strongly that early diagnosis and early operation are the two factors upon which we must depend to achieve greater success in saving the unfortunate victims of this deplorable and terribly fatal complication of enteric fever. The proposition that the sooner a hole in the intestine is closed the better, can hardly be debated. It is an axiomatic truth. As a general principle, it does not admit of argument. Granted certainty of diagnosis, the great argument against immediate operation is the presence of shock. Now, our cases marked shock generally, I think I may say in every case, indicated a large perforation, or at least the escape of a considerable quantity of contents from the gut into the peritoneal cavity. If the opening was small, intra-intestinal pressure was great, so that the total of result was the same as if a larger opening obtained. To wait for shock to pass simply means the allowance of time for the spread of the infection and the development of a condition rendering subsequent cure more and more difficult. In the majority of cases anything like shock is absent at first. We should aim to anticipate shock, and by so doing give aid while the infection is still confined to the narrowest possible area.

In many cases there is a period of a few hours immediately following the perforation during which things seem to remain almost in *statu quo*. The tension within the bowel is momentarily relieved; sometimes the little opening is for the moment closed by a fringe of omentum or a friendly neighboring coil of intestine, and the condition only begins to increase after the intestinal tension is restored or a peristaltic wave has detached the tissue lying over the opening. This quiescent period is the surgeon's opportunity. It is the opera-

tive safety period, and when once passed the dangers are greatly increased.

Operations done at this time may possibly find a beginning peritonitis from infection through the still intact base of an ulcer. This base being found suspiciously thinned could then be enfolded and closed over by a row of sutures. That a localized peritonitis can result from infection through the thin and altered base of a typhoid ulcer is now generally admitted; and that even a fatal general peritonitis may result from infection through such a base and without macroscopical perforation is proved to be true by the Munich autopsies, where peritonitis was present without perforation in 2.2 per cent. of the cases.

Recovery from perforation of the small intestine not closed by the surgeon is, I believe, extremely uncommon. The experience gained by surgeons who have opened the abdomen and failed to find any perforation, although in some instances the symptoms present were fairly definite, has developed a doubt as to the correctness of the diagnosis in cases afterwards recovering without operation or abscess formation. This idea is put very strongly by Fitz in the following language: "Since perforation of the intestine in typhoid fever may take place without any suggestive symptoms, and since suggestive—even so-called characteristic—symptoms may occur without any perforation having taken place, it must be admitted that recovery from such symptoms is no satisfactory evidence of recovery from perforation."

We have the best possible reason, then, for interfering if we think a perforation has occurred, because by so doing we give the patient the only chance there is of recovery.

Operations in the past have been too frequently undertaken, not to close a perforation and to cleanse the infected area of limited extent, but to relieve, as far as possible, a developed more or less septic perforative peritonitis, the surgeon in such cases setting himself an almost impossible task. Our experience in the sequelæ of appendicitis has taught us that the infection from the ileum is no less virulent than from the

appendix, while the patient is in an infinitely less favorable condition to resist the general toxæmia.

A few cases of infection, limited, and resulting in abscess formation, have been reported; some of them have recovered, some of them have died. To trust to the limitation of infection is, it seems to me, a reckless attitude for the medical or surgical attendant to assume.

I hold that early operation anticipates shock in most instances, anticipates perforation or rupture of a suppurating mesenteric gland in a few instances, and may occasionally be in time to relieve the conservative adhesion of omentum or other serous surface before it is forcibly separated by peristaltic or intra-intestinal pressure. I am sustained in this view by Mikulicz, who said at Magdeburg, in 1884, "If suspicious of a perforation, we should not wait for an exact diagnosis and for peritonitis to develop to a pronounced degree, but, on the contrary, one should immediately proceed to an exploratory operation, which in any case is free from danger."

Early operation should certainly save those that could get well without operation and some others that might be lost by delay.

In the two cases in which I found no perforation, ether anaesthesia was employed, and there was no shock or unpleasant symptom in either case. An exploration might be undertaken readily under local anaesthesia, and then a little ether given later on if found desirable. As to the operation itself, the incision should vary with the probable locus of the perforation. As the great majority of the perforations are near the cæcum, at least in the terminal eighteen inches of the ileum, the lateral incision is frequently indicated in early operations. If a general infection of the pelvic and small intestinal area has already developed, I find a median incision gives better access to all parts of the abdomen than any other; but if the case is recent and localized, the most direct approach is the most satisfactory, and permits the closure of the opening with the least danger of the mechanical spreading of the infection.

during the necessary manipulations. For this reason in suitable cases I prefer the right lateral incision.

A number of our cases have succumbed to the second or third, and, in one of my cases, to the fourth perforation which occurred on the forty-second day after the first operation. It is therefore advisable to make a careful inspection of the distal three feet of the ileum and to sew in all suspicious-looking and feeling ulcers.

After local cleansing with gauze swabs or irrigation with hot normal saline solution, according to indications, my practice has been to leave the abdomen full of the saline solution, to insert a rubber tube down to the bottom of the pelvis and clamp it, or, if a glass tube is used, to close the end with sterilized cotton.

If the pelvis is infected, and it generally is, I believe it to be most important to put the patient in the Trendelenburg position, and to carefully cleanse the pelvic cavity. One can do this so much more thoroughly after exposing it to view.

If the patient is in good condition, without pulmonary complications or renal insufficiency, ether anaesthesia gives the surgeon a better opportunity for thoroughness, but in bad conditions, especially with renal disease, one can get along very well with local anaesthesia. These patients are often extremely toxic and apathetic. The sensorium is dulled and the sensitivity to pain lessened.

I have not gone into the bacteriology of these cases. To work out and classify the bacterial flora in each case requires a larger staff than I have at my disposal. The reports are often in two words,—mixed cultures,—by which I am to understand that different varieties of colon bacilli are present with staphylococcus; streptococci are reported present in a minority of cases, and the typhoid bacillus in only one. In many the report is that the seropurulent fluid is sterile, although the peritonitis was clearly septic, and subsequently proved fatal.

I have purposely devoted my time to the most formidable form of perforation, viz., that into the free abdominal cavity. The more infrequent causes of peritonitis connected with the

bile passages, stomach, and spleen will afford ample scope for the exercise of surgical resource. The method of procedure in these cases must be very largely dependent upon the particular conditions found in each individual case and upon the condition of the patient.

The extraperitoneal perforations are not at all common. I have opened and drained one abscess which gradually developed in the left loin during convalescence from typhoid. There were no symptoms pointing to the kidney or spleen. The pus had a faecal odor, and the patient, a young woman, made a good recovery. One of my colleagues in the Montreal General Hospital had a similar experience. He opened an abscess in the right loin under like circumstances, the patient making a good recovery.